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Review paper

SELECTION OF PERFORMANCE MEASURE SYSTEM AS A BASE OF AIRPORT OPERATIONAL CONTROL USING MULTI CRITERIA DECISION MAKING APPROACH

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Tatjana Stevanović, Jelena Stanković

Faculty of Economics, University of Niš, Serbia

Abstract. *In contemporary's business environment, successful company must be socially responsible and environmentally conscientious in addition to essential tendency for maximizing profits, because only in this way can it ensure competitiveness in the market. Performance measuring of the airport is a critical management activity, which must be consistent with the goals, strategies and key success factors. Since the decision making is based on facts about considered task and their detailed analysis, the essence of optimization consists of the requirement to choose the best variant from the range of possible alternatives, on the basis of the adopted criteria. In this regard, in the example of the airport, there is a tendency to optimize by multiple criteria, where in the addition of essential economic, the environmental, social and other criteria are included.*

Key Words: *performance management, business, utility and environmental objectives, decision making.*

INTRODUCTION

The complexity of the environment in which modern companies operate, upgraded by internal complexity caused by the size of the company's high level of diversification of activities, a complex organizational structure, the complexity of communicating and coordinating activities between the different areas of responsibility, etc, requires a high degree of flexibility, fast decision making, good relationships with suppliers, successful coordination and effective performance of internal business processes.

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Corresponding author: Tatjana Stevanović
Faculty of Economics, Trg Kralja Aleksandra 11, 18000 Niš, Serbia
Tel: +381 18 588-068 • E-mail: tatjana.stevanovic@eknfak.ni.ac.rs
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Achieving the goals forces management to continually search for sources of competitive advantage and coordinate the objectives and business strategy with developments in the region. In this way it is possible to reach the required level of effectiveness, ie. take appropriate business activities. On the other hand, conditions of the internal complexity require the ability to successfully coordinate internal business processes and creating the potential for achieving the desired efficiency, i.e. conducting business activities in the best possible way.

Strategic and operational controls are a strong support in managing of the entrusted resources and achieving the strategic and operational objectives. The role and importance of strategic and operational controls have evolved from a focus on internal efficiency and performance measurement, to active participation in the process of performance management, providing coordination of information needs of managers at all levels of organizational and management structure and preparation of information in accordance with management needs.

The aim of this paper is to highlight the specifics of choice performance measures system of airports, as the basis for operational control. In this regard, in the begining, the essence of operational control on the example of European and U.S. airports will be explained illustrating the selection of the appropriate measure of performance called the system using multicriteria approach. Below, the basic hypothesis is that the performance of the airport can be effectively and successfully modeled using a multi-criteria analysis method. Applying TOPSIS method the composite indicator of performance of the airport collectively will be formed, from the aspect of all observed performances.

1. Conceptual Basis of Operational Control

Strategic and operational control must be in function of company performance management. In this regard, good performance management means adhering of strategic and operational control to the the information needs of management at all levels; coordination of activities between different actors in the supply chain; upgrade of financial performance measures by nonfinancial ones and linking business strategy and operations. The system of strategic and operational controls to be applied in a particular business system is determined by the nature of the environment, competitive pressures, organizational structure, technical and technological potential, size and business strategy (Malinić, 2005, p. 93-95).

The essence of operational control consists in increasing the efficiency of enterprises. The main goal of operational control is a more efficient use of existing resources to achieve the company expected earnings, the creation of a satisfactory financial structure and positive cash flow, i.e. liquidity. From this goal comes the main task of operational control, which consists of passive adaptation to changes in the environment, by influence on the internal factors' success.

The operations are the essence of the development of profitable companies with traditional directionality to the efficiency of production / service and minimizing costs. In recent years the connection between strategy and operations is emphasized, as a set of strategic, complex and diverse variables that are crucial at the current and future profitability of companies. The dimensions of the operational level that are often considered to be of strategic importance as design, compliance and time (Stemsrudghagen, 2003).

Quality of design is often described as an important strategic weapon, and instruments such as the functional analysis of costs and target costsing support the specification and development of products / services that meet customer needs, mediating between the needs of customers and design products.

Quality of conformity refers to adherence to the principles developed in the design process. This effort may also be of importance for the strategic positioning of companies, including systems and statistical techniques that are often used in practice, such as ISO 9000, PDCA style (plan-do-check-act) etc.. The quality of compliance affects the cost of quality, namely, that determines the level of a single optimal combination of direct, i.e. costs of prevention and detection of defects on products and indirect costs that arise due to defects in the products detected before and after the sale. The quality of compliance should be operationalized as a deviation or departure from the target value, the basic message that quality costs increase exponentially with the deviation from target values.

The last dimension of the operational level, *time* is often considered the main contributor to profitability. This dimension includes such factors as: the period from conception to market, with the potential to reduce the resources spent on research and development, increase production and service efficiency, increasing the reliability and timeliness in responding to consumer demands, and consequently reduce costs and increase revenue. Time management is associated with the issue of maximizing the contribution of limiting factors, which move through the company as a system, to the result of the company as a whole, in unit of a period time. This means that the economy of time in a state of flux, depending on factors such as demand, supply of inputs and situations in different parts of the company.

To help managers at all levels in managing in the short term, operational control provides convenient instrumentation consists of calculating the target cost, activity based costing, management by exception, benchmarking, EVA, Balanced Scorecard, cost-benefit analysis and the like. Some of the tools of operational controls, such as EVA and the Balanced Scorecard, find their application in strategic control.

The core operational control makes budgetary control, which includes accounting planning and accounting control (Novićević, Antić, 2009). The primary role in the budgeting process is taken by financial performance measures, set for annual and shorter time intervals, such as earnings, cash flow, return on investment, and return on equity. Their determination is made as to the level of company, and the level of profit and investment centers. Establishing a set of financial performance measures in the budgeting process is the standard for accounting control. However, the need for more comprehensive performance measurement and their connection with the achievement of strategic objectives, give room to using elements of integrated, multi-dimensional systems, which equally respect financial and nonfinancial performance measures, in the process of operational control.

Operational control, diagnostic in nature, is one source of information for strategic control. Strong link between goal setting - the choice of strategies - operational activities, required to successfully implement formulated and developed business strategies. Therefore, the unique combination and synergies of strategic and operational control turn into imperative of an effective performance management of the modern company.

2. Airport Performance Measurement - Practical Examples

In this paper we glimpse the current practice of measuring performance at airports with a critical review of some of the present deficiencies that can reverberate in the operational control of these companies. The presented analysis (Humphreys, et al., 2002, p. 264-275) reflects the results of a series of performance measurement projects in regulated sectors, of benchmarking in the air transport and additional interviews with managers of the airlines. Additional information provided by a range of 15 semiformal face to face interviews with managers of European airports, different sizes, with a turnover of over one million passengers a year.

Airports have traditionally been considered public property and subject to state support and control. For the past few decades, they tend to become independent and self-sufficient by placing their own financial goals, or the introduction of private property. Full privatization was launched in the UK in 1987, and to date more than 50 countries have introduced some form of private ownership in air transport, raising the issue of the importance of performance measures for the owners and the governments of individual countries (Humphreys, et al., 2002, p. 264-275).

Airport managers are dedicated to performance measurement as a critical management activities, for three main reasons: measuring the operational efficiency, evaluation of alternative investment strategies and regulation of airport activities by the government. In addition, it is important to make the airport in the public domain be responsible to government and the requirements it sets.

Generally, the *strategic objectives* of the airport can be broken down into: *financial goals, quality of servicing goals and environmental goals*. Financial targets related to achieving superior financial results by the intensification of transport services, quality goals include top quality services that airports provide to their customers, while the environmental objectives related to minimizing the negative impact of the airport to immediate surrounding environment.

The complexity of airport activity is reflected in a multitude of performance measures. The tendency of selection of measures that simplify performance measurement is a risk of excessive simplification and loss of their use in the management or government. Therefore, creating an airports performance measurement system should be approached as a process that consists of a series of interrelated steps, each of which represents a very important link in the chain of lighting give the appearance and contribute to successful operational control and monitoring of achieving the strategic goals of the company.

The new competitive reality, turbulent environment where this area to the business is very exposed, suggests that success in competition with an increasing number of private airports ith top performance, requires the adoption of a *strategy of confrontation* and of the airport in the public domain.

Responding to the challenges of the *strategy of confrontation*, airports are trying to provide high value for users, while reaching profitability, innovation and flexibility to changes in the environment. Accordingly, the *key success factors* in this sector include the *cost, time, quality, innovation and flexibility*.

In accordance with the goals and key success factors, *performance measures* of the airport can be divided into three main categories: *business performance measures, measures of service quality and measures of ecological performance*. Business measures are used to evaluate financial results and by their nature are quantitative, measures of airport services seen from the perspective of quality and quantity, and environmental measures indicate the external impact of operations on the ecosystem.

Using of *business measures* in the airline industry, led by management, relies on well-known branch indicators, such as the *cost per kilometer of available seats, and profit per passenger kilometer*. *Unit workload* (UR) is a measure of performance used by 13 out of 15 European airports surveyed. This indicator, which is linked to the capacity of aircraft, defined as a passenger or 100 kg of cargo, and presents an attempt to introduce a single measure for passenger and freight traffic. Measures presence in more than 2/3 of the sample relating to total *operating costs per JRO, staff costs per JRO, total revenue per JRO, aeronautical revenue per JRO, aeronautical revenue per JRO and JRO per the employee*. These operating parameters are used to the performance assess of various aspects of airport and progress in relation to its business objectives.

The interviews showed the typical performance measures for the major European airport from FLAP group (airports of Frankfurt, London, Amsterdam and Paris), which relate to the *gross profit per passenger, operating profit per passenger, net profit per passenger in transit and net profit per JRO*.

Measures based on income, such *income per JRO, revenue per passenger and per take-off* (*in%*) are still very common, but those do not talk about profitability. The information indicated that the FLAP group developed measure of profit per passenger for various activities, such as a *marginal result per employee* and *marginal result per passenger*.

The U.S. experience suggests the use of performance measures of publicly owned airports in the context of responsibility to federal government. Airport must comply with Federal Accounting Standards of Federal Aviation Administration - FAA and must meet adequate performance levels in order to receive matching funds from the budget. Financial measures such as revenue per passenger, spending per passenger, revenue flight operations and concessions, which reflect the need for investments on an annual basis, are used as in Europe.

Managers, regulators and governments must measure the performance of services at airports. *Services measures* are used for assessing the quality of everyday services that airports provide to their customers, and are particularly useful for the identification of operational problems. Regulatory bodies and government agencies use these measures to track performance airports to ensure respect for the interests of users and provide input for decision making, planning and control at airports.

Measures of service, based on the subjective perception of users regarding service quality, as determined by surveys in which it is required from the users to rate their experience on a scale of 1 to 5 points. General measures relating to the *overall passenger satisfaction, comfort and sign of terminal, terminal and toilet cleanliness, the checking satisfaction, overall satisfaction by catering, the proceeds to buy in the stores, baggage manipulation satisfaction, the availability of tape storage, and overall standards of the fleet*. Objective measures for more than half of the airport related to the *time of response to customer comments, the waiting time at check-in, luggage delivery, taxes and the percentage of waiting time due to flight delays in relation to the total time*.

Measuring performance of airport services in the United States is set at system level by the Federal Law on performance and results from 1993 that requires from the FAA that their goals connect with the published results of the measures. In response, more performance measures developed within the United States in order to monitor the efficiency and effectiveness of the investment, development policy and planning at the state and federal level. The National Plan of Integrated Airport Systems from1998 collects performance data at the national level, indicators such as the *airport capacity, safety, noise impacts, the conditions, safety, accessibility, average flight delays and financial performance*. It identified the need for measuring of the operation on terminals, but this did not address the lack of adequate measurement techniques.

The importance of *environmental performance measures* in particular stand out to monitor the impact of airport operations on the immediate environment. *Noise (the number of homes within the noise contours in the average sixteenhours working days), access to the surface (number of passengers using public transport) and waste (kg per passenger)* are the most famous airport impacts on the environment to be monitored. Government and local communities using measures of environmental performance in order to maintain control over external effects of air traffic. Management, however, uses these measures to monitor the impact of airports on the environment and compliance with environmental standards of business.

The expansion of airports in Europe has caused the introduction of many measures beyond the traditional agreement of limits of the noise, which is often used when approving the expansion of airports in order to protect the community. An interesting example is a range of measures relating to the Manchester airport, one of the few airports in Europe to receive permission to build another runway, thanks in part to the list of 34 key eco targets that can be externally monitored each year. Examples of key environmental measures of Manchester airport include the average weekly use of electricity (in min.), response to complaints (long-less than 5 days), kilowatt-hour of energy per m^2 of surface area, % of the exploited planes per year, annual % of waste recycling, water consumption per passenger (in l.).

3. Multi-criteria Approach to Airport Performance Management

Making decisions is based on the argumented facts about the considered task and their detailed analysis, and the essence of optimization is in request to choose the best option from the range of possible alternatives or the best solution based on the approved criteria. Optimization criteria are mostly economic in their nature, primarily because it is the optimization of an economic system and the results are increased profits, minimized costs, or in one word - the increase of financial welfare of the system. This is the main reason why it has been considered enough for a criterion for optimization to be usually profit maximization or cost minimization of system functioning.

Modern business environment, however, is thinking towards sustainability of business and also puts in focus some requirements that are not economic in nature. Specifically, there is a tendency to perform optimization on several criteria, which essentially in addition to economic, recognize a number of other requests: ecological, social, and so on. Successful company in today's business environment is not just there to make profit, but the company that is socially responsible and environmentally conscientious, because only in this way it can ensure competitiveness in the market.

The performance management airline companies's appreciation trend of non-economic criteria in assessing the performance thus takes place. The goal in multicriteria analysis, in that sense, is the formation of a composite indicator that represents the collective evaluation of the fulfillment of economic, as well as non-economic criteria. In this way, not only does performance evaluation of the company occur, but also a kind of mark of sustainability of its operations.

3.1. Decision matrix for multi-criteria analysis model of performance management

By definition, a multi-criteria analysis methods related to solving the problem of choosing from a range of m alternatives A_i (i = 1, 2,..., m) based on n criteria X_j (j = 1, 2,..., n) (Figure 1). Each alternative represents a vector $A_i = (x_{i1}, x_{i2},...,x_{ij},...,x_{in})$. Coefficients $x_{i1}, x_{i2},...,x_{ij},...,x_{in}$ by which vector A_i is determined are called, in the usual methodology of multicriteria analysis, attributes. Therefore, the value of the x_{ij} coefficient is actually a value of j^{th} attribute for the i^{th} alternative (Stanković, Stevanović, 2006). This value indicates at what level the i^{th} alternative is reaching j^{th} criterion. The level of achievement criteria is nothing more than the value of the parameters that have considered alternatives for a given criterion. The most common way of presenting the problem of multicriteria analysis matrix form, a decision matrix is defined in terms $|x_{ij}|_{m\times n}$. Decision matrix coefficients can be quantitative measures, established by empirical measurements, and qualitative evaluations, defined on the basis of past experience, or assessments of the decision makers. Precisely because it includes a multi-criteria analysis and qualitative assessment of the level of achievement, criteria can be interpreted as a synonym for the level of benefits reaching the decision maker as estimated by their subjective perception.

Thus, the formation of multi-criteria analysis model implies the existence of relevant information on possible alternative actions of realizing the process for which the decision is made, the goals that the decision maker wants to achieve, but also data on how each of the available alternatives contributes to achieving a certain goal.

The problem of performance management in the company, which is the subject of this paper, involves the evaluation of the company by three main groups of criteria:

1. financial performance measures,
2. measures of service quality and
3. environmental performance measures.

As financial performance measures the following were analyzed: (1) cost per km of available places (in €), (2) profit per passenger km, (3) the total cost of operations by JRO, (4) gross profit per passenger, (5) operating profit per passenger, (6) net profit per passenger in transit and (7) net profit JRO. Assuming that the evaluation included three hypothetical airports, a decision matrix related to the performance measures is presented in Table 1 - Part I.

Relevant measures of service quality in the model were estimated by the following sub-criteria (Table 1 - Part II): (1) overall passenger satisfaction, (2) satisfaction at check-in, (3) catering overall satisfaction, (4) manipulation of luggage satisfaction, (5) the availability of tape storage, (6) the reaction time on the comments of travelers (in days), (7) the waiting time at check-in (in minutes), (8) delivery of luggage (in minutes), (9) and taxes (10) wait time due to flight delays in relation to the total time in %. Sub-criteria of (1) to (5), as well as the criterion (9) are qualitative in nature and are supposed to be rated by the rating scale Likert-type, where the lowest score preference is 1, and the highest is 5.

Table 1. Part I

	Financial performance measures						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Data Type	*Quant.*	*Quant.*	*Quant.*	*Quant.*	*Quant.*	*Quant.*	*Quant.*
Criterion Type	*Min*	*Max*	*Min*	*Max*	*Max*	*Max*	*Max*
Airport 1	0.27	0.14	87	42	32	11	45
Airport 2	0.22	0.12	81	39	27	9	42
Airport 3	0.31	0.18	92	45	34	12	51

Table 1. Part II

	Measures of service quality									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Data Type	*Qualit.*	*Qualit.*	*Qualit.*	*Qualit.*	*Qualit.*	*Quant.*	*Quant.*	*Quant.*	*Qualit.*	*Quant.*
Criterion Type	*Max*	*Max*	*Max*	*Max*	*Max*	*Min*	*Min*	*Min*	*Max*	*Min*
Airport 1	3	2	4	3	4	2	21	15	1	5
Airport 2	2	3	2	4	3	2	17	12	1	4
Airport 3	4	3	4	3	5	3	10	9	2	7

Environmental performance measures were evaluated through three sub-criteria: (1) the amount of waste per passenger (in kg), (2) annual % of waste recycling and (3) water consumption per passenger in l. Environmental performance measures in decision matrix hypothetical problems are given in Table 1 - Part III.

Table 1. Part III

	Environmental performance measures		
	(1)	(2)	(3)
Data Type	*Quantitative*	*Quantitative*	*Quantitative*
Criterion Type	*Min*	*Max*	*Min*
Airport 1	0.8	22	1.2
Airport 2	0.6	18	1.5
Airport 3	0.7	34	1.1

To solve previously defined problem TOPSIS method is used.

3.2. TOPSIS method

The problem of multi-criteria analysis with *m* alternatives and *n* criteria, may be interpreted as a geometric system of *m* points in *n*-dimensional space. Starting from this fact, Hwang and Yoon (1981) developed a method *Technique for Order Preference by Similarity to Ideal Solution* (*TOPSIS*), based on the notion that the optimal alternative, or a point that represents it, should have a minimum distance from the positive-ideal and the maximum distance from the negative-ideal solutions in the geometric sense.

The ideal solution is defined as a set of ideal values of attributes for all criteria and ideal level at which the benefit of decision-makers is the highest possible. This is a solution whose attributes have the maximum possible value for revenue and minimum possible value for the cost type of criteria. Such a solution is usually very rare and its significance is that the solving problem of multicriteria analysis endeavors such solution. As a further alternative to the ideal point, the benefit of decision-makers decreases steadily. However, the ideal solution is often impossible or unatainable in terms of real economic problems, so that a rational choice decision-making exemplified by decisions optimizes that the decision should be as close as possible to the ideal solution.

Optimal decision, in this regard, is the one which will mostly meet all the relevant criteria, collectively observed. Specifically, from the aspect of individual criteria, it is easy to determine the alternative that achieves the best value. The ideal solution is the equivalent of such alternatives and to all the relevant criteria. On the other hand, the ideal solution is hard to maintain, except under laboratory conditions, and therefore, determines the optimal solution that achieves the preferred value for the maximum number of criteria in the model.

Every ideal solution for TOPSIS methods without obtaining the type attribute is defined through two segments: (1) determining the positive-ideal solution and (2) determining the negative-ideal solution.

Formally, the positive-ideal solution is defined (Hwang C.L., Yoon, 1995):

$$A^* = (x_1^*, ..., x_j^*, ..., x_n^*) \quad (1)$$

where x^*_j is the best value of the j^{th} attribute among all available alternatives, or for the revenue type attributes x^*_j it is determined as $max_i\, x_{ij}$. In accordance with the preferences of the decision maker, for the expenditure type attributes, value x^*_j is determined as $min_i\, x_{ij}$. When it comes to economic issues, these two types of attributes (revenue and expenditure) are dominant. However, in rare cases, there are also attributes that are unmonotonous, which are in one segment directly in accordance, while in the second inverse correlative with the preference of the decision maker. An example of this type of attribute would be the temperature of the space. In this case, the value x^*_j is defined as the preferred value for the observed category.

In contrast to the positive-ideal solution, the negative ideal solution

$$A^- = (x_1^-, ..., x_j^-, ..., x_n^-) \quad (2)$$

form the least preferred value j^{th} attribute of the available alternatives. Therefore, the revenue value attributes x^-_j is defined as $min_i\, x_{ij}$, while, for the expenditure type attributes, value x^-_j is determineted as $max_i\, x_{ij}$.

Geometrically observed, the closest alternative to the positive-ideal solution does not have to be the most distant from the negative-ideal solution. Thus, the problem of determining the optimal alternative arises when there are two alternatives that are either closest to positive ideal solution and the farthest from the negative-ideal solution, respectively, which brings into question when is the utility of the decision maker larger and which alternative should be selected as optimal decision.

TOPSIS method overcomes the problem of defining the mentioned indices approximations, or its closeness to the positive-ideal solution, combining a near-perfect positive and negative-ideal distance from the observed alternative solutions. The optimum alternative is determined with the highest index approximation to positive-ideal solution.

TOPSIS method will be presented in six successive steps (an algorithm by Hwang CL, Yoon, 1995).

The initial step of the TOPSIS method algorithm implementation involves determining R – the normalized matrix of coefficients r_{ij}, using vector normalization defined by equations:

$$r_{ij}^{+} = \frac{x_{ij}}{\sqrt{\sum_{i=1}^{m} x_{ij}^{2}}} \qquad r_{ij}^{-} = \frac{\frac{1}{x_{ij}}}{\sqrt{\sum_{i=1}^{m}\left(\frac{1}{x_{ij}}\right)^{2}}} \tag{3}$$

where r_{ij}^{+} are normalized values of revenu type attributes, and r_{ij}^{-} are normalized values of cost type attributes. Values $x_j{*}$ and x_j^{-} are calculated according to relations:

$$x_j{*} = \max_i x_{ij} \tag{4}$$

$$x_j^{-} = \min_i x_{ij} \tag{5}$$

The next step is to determine preferential normalized matrix V with coefficients v_{ij}, defined as the product of a vector of normalized decision matrix R and the vector of weights according to the relation:

$$v_{ij} = r_{ij} w_j \tag{6}$$

With this matrix, the process of determining optimal alternatives is introduced, as well subjective preferences of the decision maker expressed through weight coefficients of the observed, relevant criteria. Assumptions of performance management in companies with a public-private partnership are that all three sets of issues are of equal importance. In line with this are the weight coefficients for all sub-matrixes in the group of decision-making and financial performance measures amount to 0.048, in the measure of quality, amount to 0.033 and 0.111 in the group of environmental measures.

The third segment of the iterative procedure TOPSIS method is the identification of positive-ideal and negative-ideal solutions. Values v_j^{*} and v_j^{-} by which a positive-ideal solution A^{*} and negative- ideal solution A^{-} are defined are determined to the relative preferential normalized coefficients as:

$$A^{*} = \{v_1^{*}, v_2^{*}, ..., v_j^{*}, ..., v_n^{*}\} = \left\{ (\max_i v_{ij} \middle| j \in J_1) \wedge (\min_i v_{ij} \middle| j \in J_2), i = 1,2,...,m \right\} \tag{7}$$

$$A^{-} = \{v_1^{-}, v_2^{-}, ..., v_j^{-}, ..., v_n^{-}\} = \left\{ (\min_i v_{ij} \middle| j \in J_1) \wedge (\max_i v_{ij} \middle| j \in J_2), i = 1,2,...,m \right\} \tag{8}$$

where J_1 is a set of revenue criteria, while J_2 is a set of cost criteria. Depending on the defined problems, it is possible to define a set J_3, as a set of unmonotonius criteria.

Positive and negative ideal solutions of observed problem are given in Table 2 (Part I, II and III).

Table 2. Part I – Positive and negative ideal solutions for financial mesure performances

Positive ideal solution	0.032344	0.033264	0.029296	0.029407	0.030018	0.030720	0.030381
Negative ideal solution	0.022954	0.022176	0.025794	0.025486	0.023838	0.023040	0.025020

Table 2. Part II – Positive and negative ideal solutions for service quality measures

Positive ideal solution	0.024759	0.021320	0.022222	0.022866	0.023570	0.021320	0.026579	0.024041	0.027217	0.023770
Negative ideal solution	0.012380	0.014213	0.011111	0.017150	0.014142	0.014213	0.012657	0.014424	0.013608	0.013583

Tabela 2. Part III – Positive and negative ideal solutions for environmental measureses

Positive ideal solution	0.073309	0.085244	0.072052
Negative ideal solution	0.054982	0.045129	0.052838

One of the key steps in TOPSIS method is to calculate the alternative measure of distance from the positive-ideal and negative-ideal solutions. The distance from the positive-ideal solution is calculated as:

$$S_i^* = \sqrt{\sum_{j=1}^{n} (v_{ij} - v_j^*)^2}\ , \quad i = 1, 2, ..., m \tag{9}$$

Derogations from the positive ideal solution of observed problem are given in Table 3.

Table 3. Derogations from the positive ideal solution

	Value	Rang
S1*	0.045120	2
S2*	0.054308	3
S3*	0.019927	1

Analogously, the alternative distance of the negative-ideal solution is calculated as:

$$S_i^- = \sqrt{\sum_{j=1}^{n} (v_{ij} - v_j^-)^2}\ , \quad i = 1, 2, ..., m \tag{10}$$

Derogations from the negative ideal solution of observed problem are given in Table 4.

Table 4. Derogations from the negative ideal solution

	Value	Rang
S1-	0.024885	3
S2-	0.134915	2
S3-	0.164804	1

From Table 3 and Table 4 it is clear that in both cases the best alternative is Airport 3, while in other cases there is rank inversion. Namely, the Airport 1 is closer to the positive ideal solution, but it is also closer to the negative ideal solution, which gives it a lower priority.

Calculation of the proximity index (C_i^*), or closeness of observed alternative to the positive-ideal solution is also the step where the importance of alternatives is determined in terms of meeting all the criteria.

Index C_i^* is derermінated as:

$$C_i^* = S_i^- / (S_i^* + S_i^-), \quad i = 1, 2, ..., m \tag{11}$$

Relative proximity index values are in the range $0 \leq C^*_i \leq 1$, where C^*_i=0 when the alternative A_i is equal to negative-ideal solution, or $A_i = A^-$ and $C^*_i = 1$ when the alternative A_i is equal to positive-ideal solution, when $A_i = A^*$. Index of relative proximity for this problem is given in Table 5.

Table 5. Relative proximity index values

	Value	Rang
C1*	0.355471	3
C2*	0.712996	2
C3*	0.892130	1

The final step of the TOPSIS method involves the ranking of alternatives. From the above it can be seen that the third alternative or Airport 3 shows the best performance measures for all three aspects: financial measures, measures of service quality and environmental measures. This assessment can be considered as a composite indicator that provides evaluation and sustainability of the company's operations.

CONCLUSION

Measuring the performance of the airports, as examples of companies in the long-term public ownership is a critical management activity, which must be consistent with the goals, strategies and key success factors. In this sense, airport performance measures can be divided into three main categories: business performance measures, service performance measures and performance measures of the environment.

Service organizations are inherently different from others and require different systems to measure performance. Accordingly, the airport managers are faced with dynamic environments relevant to recognizing that new strategies and competitive realities demand new measurement systems. Therefore, it is necessary to change over the treatment of financial size as a basis for performance measurement system to their perception as part of a broader set of measures.

Airport performance measures should be defined taking into account the different segments of transport, different types of passengers, with different desires and needs. In this way, a more meaningful comparison to the airport is possible thanks to the perception of the full set of variables such as size, traffic profile, age, regulation, location, culture, stakeholders, and the like. These variables will shape the nature and level of the performance of the airport in a way that can strongly affect the comparisons between airports. In addition, normalization opens the way to development and overcoming some of the earlier barriers to the implementation of benchmarking.

The aim of the application of multicriteria analysis in performance management of airports is the establishment of composite indicator that represents the collective assessment of the fulfillment of economic and non-economic criteria. Therefore it is not only an evaluate performance of a company business, but also a kind of rating of the sustainability of its operations. Starting from these applications, the authors of the paper will focus in future research on the application of this methodology to evaluate the financial, as well as non-financial performances of other service industries, as well as non-profit organizations.

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IZBOR SISTEMA MERA PERFORMANSI KAO OSNOVA OPERATIVNE KONTROLE AERODROMA PRIMENOM VIŠEKRITERUJUMSKOG PRISTUPA ODLUČIVANJU

Tatjana Stevanović, Jelena Stanković

U savremenom poslovnom okruženju, uspešna kompanija pored maksimiranja profita, mora biti društveno odgovorna i ekološki savesna, jer se jedino na takav način može obezbediti konkurentnost na tržištu. Merenje performansi aerodroma, predstavlja kritičnu menadžment aktivnost koja mora biti usklađena sa postavljenim ciljevima, strategijama i ključnim faktorima uspeha. Kako se donošenje odluka bazira na argumentovanim činjenicama o razmatranom problemu i njihovoj detaljnoj analizi, suština optimizacije se sastoji u zahtevu da se iz niza mogućih alternativa izabere najbolja varijanta, i to na osnovu usvojenog kriterijuma. S tim u vezi, javlja se težnja da se optimizacija na primeru aerodroma vrši po više kriterijuma, gde se pored esencijalnih ekonomskih, uvažavaju i ekološki, socijalni i drugi kriterijumi.

Ključne reči: *upravljanje perofrmansama, poslovni, uslužni i ekološki ciljevi, donošenje odluka.*